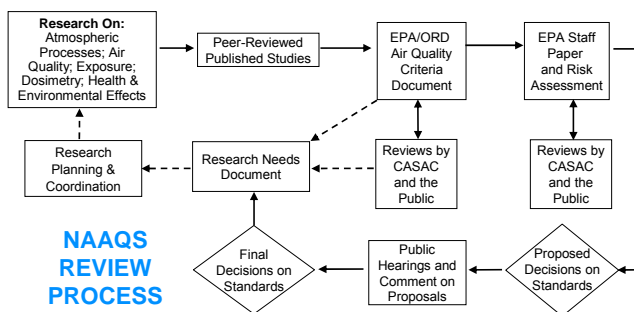


# SCIENTIFIC BASES FOR THE DEVELOPMENT OF THE NAAQS FOR OZONE



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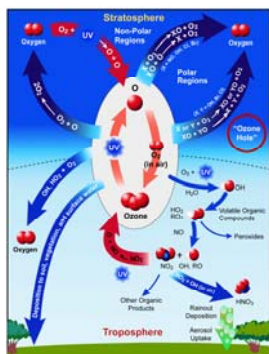
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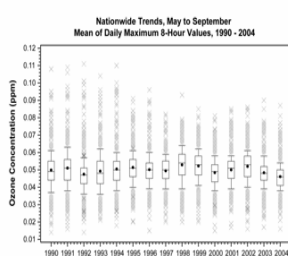
## OZONE CHRONOLOGY AND REVIEW TIMELINE

1979	1997	Jan 2005	May 2005	Aug 2005	Dec 2005	Mar 2006	Mar 2007	Dec 2007
Standard Set ≤ 0.12 ppm (1h)	Standard Set ≤ 0.08 ppm (8h)	1 <sup>st</sup> External Review Draft	CASAC Review	2 <sup>nd</sup> External Review Draft	CASAC Review	Final O <sub>3</sub> AQCD	Proposed Decision	Final Decision

## ATMOSPHERIC CHEMISTRY/ENVIRONMENTAL CONCENTRATIONS



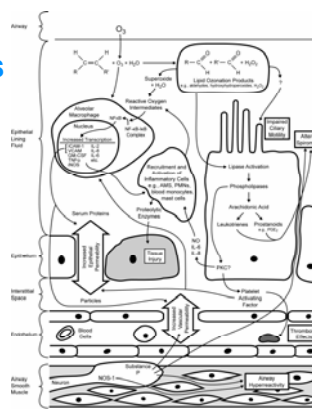
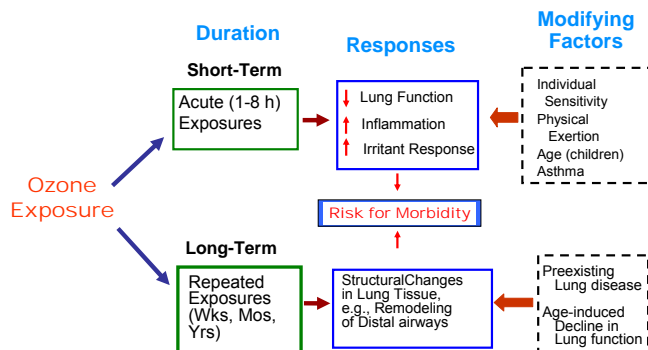
Schematic overview of stratospheric and tropospheric O<sub>3</sub> photochemistry



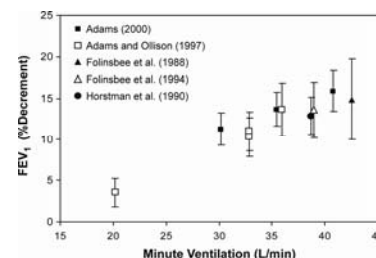
Nationwide composite O<sub>3</sub> concentrations from 1990 to 2004. Although the highest O<sub>3</sub> values have declined over the past 15 years, values towards the center of the distribution have remained nearly the same.

## HEALTH EFFECTS

### Ambient Ozone Exposure-Induced Health Effects



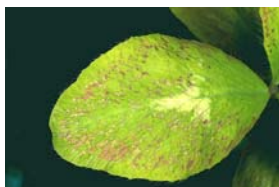
Mechanisms of O<sub>3</sub> toxicity



Forced expiratory volume in one second (FEV<sub>1</sub>) decrements (mean ±SE) for prolonged 6.6 h exposures to 0.12 ppm O<sub>3</sub> as a function of exercise V<sub>E</sub>.

## ENVIRONMENTAL EFFECTS

- Chronic O<sub>3</sub> effects linked to the senescence process or some physiological response very closely linked to senescence (e.g., translocation, reabsorption, allocation of nutrients and carbon).
- O<sub>3</sub> reduces the growth and yield of numerous common and economically valuable plant and tree species.
- O<sub>3</sub> affects the production, structure, and chemical components of wood.
- O<sub>3</sub> affects the nutritional quality of crops for foraging animals and possibly humans.
- O<sub>3</sub> causes visible foliar injury that has effects on the aesthetic value of ecosystems.
- O<sub>3</sub> may be altering the diversity of plant communities.



O<sub>3</sub> injury to red clover (*Trifolium pratense*) and white pine (*Pinus strobus*)  
Photos by J. Holopainen and A.S. Heagle

## HEALTH EFFECTS CONCLUSIONS

- Human experimental, animal toxicology, and epidemiologic studies show that acute O<sub>3</sub> exposure is clearly associated with decrements in lung function.
- Acute O<sub>3</sub> exposure is also linked with increased respiratory symptoms, particularly in asthmatic children, airway inflammation and airway responsiveness.
- Acute O<sub>3</sub> exposure is associated with increases in hospital admissions and emergency department visits for respiratory diseases, especially during the warm season (when O<sub>3</sub> levels are higher).
- Recent studies suggest that acute O<sub>3</sub> exposure contributes to cardiovascular morbidity.
- Evidence from multi-city and single-city epidemiologic studies, as well as several meta-analyses, links acute O<sub>3</sub> exposure with mortality.
- People with preexisting respiratory disease, children, older adults, and people with heightened exposures such as outdoor workers, appear to be at greater risk of experiencing adverse health effects with ambient O<sub>3</sub> exposure.

The views expressed in this poster are those of the authors and do not necessarily reflect the views or policies of the U.S. Environmental Protection Agency.

